Is your packaging line operating to full capacity?

Overall Equipment Effectiveness is a powerful plant key performance indicator which, when used in continuous improvement programmes for packaging lines, has been shown to identify the root cause of inefficiencies and, hence, has supported the achievement of sustainable full operating capacity.

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A few years ago, the expectation was that big pharmaceutical companies would become R&D and sales and marketing organisations, with manufacturing being subcontracted. Given the failure in the yield of many R&D pipelines, it seems that many companies have lost faith in their ability to create new chemical entities and are now refocusing on improving their core manufacturing processes and looking towards new investments in growth markets.

As a result of this altered focus within the pharmaceutical industry, there has been a rise in the numbers of investments in the areas of biopharmaceuticals, consumer healthcare, OTC medicines and generics, but generally manufacturing (that is efficient manufacturing) is becoming more important. This increasing importance is being particularly felt on packaging lines, where the need to reduce costs through efficiency savings and finding additional capacity is a constant goal, particularly because it has been necessary for many companies to consolidate their packaging facilities.

So the pressure is really on to improve processes and packaging efficiency and to generate additional profit margins. This is becoming a never-ending challenge and the pharma industry's daily mantra.

The cost to find and develop new drugs is increasingly difficult, and to stay competitive companies must drive throughput and reduce changeovers. Even if, for example, a Lean Six Sigma programme has already added an additional 15% output, where do you go from here?

In the early stages of continuous improvement, it is usual to find that adopting good practices, such as Lean Manufacturing, Continuous Improvement and Lean Six Sigma, helps to deliver improvements, but the 'easy gains' soon start to disappear. Using manual processes to collect and process data only allows you to see what the eye and pen can record: identifying the 'easy gains'. More detailed and accurate information is needed to keep the improvement programmes fuelled and targeted in the right direction.

It is also alarming to find that many of the improvements that are made initially are not sustained; when the focus of attention moves on, old habits started to creep back and the improvement is eroded. In fact, it has been suggested that at least 50% of improvement programmes are deemed to be failures over the longer term and up to 70% fail to achieve all of their intended benefits.[1]

Calculating OEE

To deliver their full potential, these continuous improvement programmes need support, cultural adoption and information (**Figure 1**).

Overall Equipment Effectiveness (OEE) is a powerful plant Key Performance Indicator (KPI) and provides a metric that can be used by operations,

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production, engineering, maintenance, quality and continuous improvement teams. It consists of three components: availability (major downtimes), performance (line speeds and minor losses) and quality.

Created by Seiichi Nakajima at Nippon Denso in the late 1960s, OEE has become a key measure used in continuous improvement and lean manufacturing programmes.

OEE is expressed as a percentage, and shows the achievement to target of your best possible production output.

OEE (%) = Availability (%) x Performance (%) x Quality (%)

Single Minute Exchange of Dies (SMED), on the other hand, is a way of working and studying changeovers to minimise their effect on production time. It is one of the Lean manufacturing tools designed to reduce waste from the production process. SMED focuses on transferring online to offline operations so they can be done before the changeover starts; using simplified connectors and fastenings; minimising adjustments and trials; and working together. Real-time systems can monitor changeover conformance and provide operational staff alerts of when a changeover is due, allowing them to conduct the offline activities, ensure new materials are ready and be at the line ready to perform the changeover. Although the terms 'Single Minute' and 'Dies' may not seem to apply to all processes, using its methods will allow any changeover to be improved.

Common problems

During recent consultations with several customers, it became apparent that prescribing a single solution to enhance efficiency would not be effective; rather it was necessary to listen to the customer's requirements and explore unrealised requirements.

For example, several of our customers were trying to improve the performance of their tabletting processes. They had to increase capacity owing to increased demand and, in one case, owing to group consolidation.

What was causing the problems?

- Tabletting performance
- Extended cycle times in the mixing process
- Blister sealing failures
- Printer indexing
- Insertion of patient information leaflets
- Final packaging
- Hidden accepted working practices

To overcome these problems, a range of solutions can be provided that can connect to plant equipment and capture running efficiency in real-time. These solutions range from simply monitoring production counts, which allows you to see when the process is running or stopped, through to solutions that are able to connect to the control equipment and monitor the true state of the line, providing the detail to focus improvements in the right areas. This approach provides staff at all levels with information to make decisions as problems occur — this being the important point.

The following are some case studies to provide illustration.

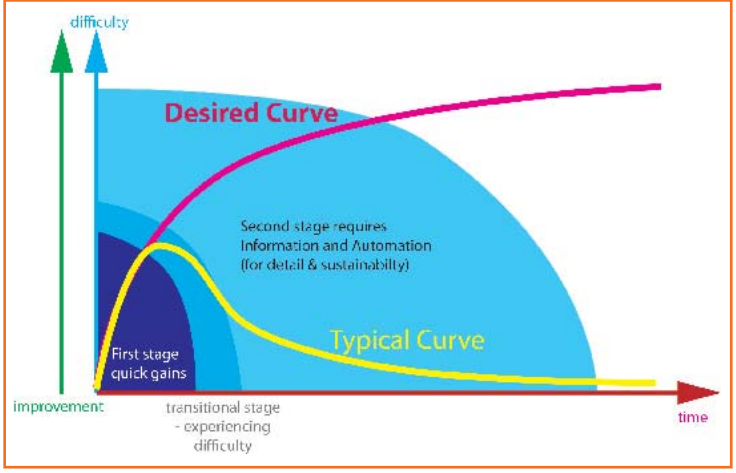
Case studies

Company: Major health supplements supplier

Problem: Lost production capacity caused by unidentified labelling issues

The problem was masked by 'hidden accepted working practices'. These usually cause significant losses in any packaging application, but are rarely highlighted. One had first to work with the customer to fully understand their issues and goals — the customer filled generic tablets into plastic containers. The labels were not being applied properly and the operators were removing the mislabelled products, peeling off the labels and then feeding them back onto the line so the labels would be reapplied.

Figure 1: Graphic shows the correlation of Improvement and Difficulty in creating sustainable and continuous improvement over Time. The yellow curve is that which is normally found as initiatives stall and get replaced. The red line is the desired improvement curve that requires automated manufacturing information. The area between 'easy improvement' and the rest is where such insight is required.



The author says...

- Up to 70% of continuous improvement programmes fail to achieve all of their intended benefits.
- Overall Equipment Effectiveness (OEE) has become a key measure used in continuous improvement and lean manufacturing programmes.
- The OEE of a typical pharmaceutical packaging line is around 30% on average. In other industries, packaging lines run at 65–75% when improvements have been made using data from real-time automated solutions.
- Several case studies are presented where problems were identified on the packaging line, which were causing inefficiencies. Upon resolution, the manufacturers noted a significant increase in production line capacity.
- There is much that can be done to dramatically affect the OEE of pharmaceutical packaging lines; the benefits of which will be sustainable and deliver increased profitability and competitiveness in the long run.

The problem in question had always existed and when it occurred it was simple for the operator to fix and get the line running again. The operators had reported the problem many times, but no one seemed to be particularly interested because its true impact on the line capacity was not being measured and understood. In other words, to manually adjust inappropriately applied labels had become an accepted working practice. The problem was not recorded on the daily production sheets as it only took 'a few seconds' to fix.

Solution and benefit: The company desperately needed additional packaging capacity so decided to install a real-time monitoring solution. The above losses became clear within the first week of monitoring and identified a 10% loss of capacity owing to incorrect labelling. A continuous improvement team was assembled and identified that the cause was due to mechanical wear in a feeder. This was soon rectified and the capacity of the packaging line was immediately improved.

Company: Supplier of medical oncology drugs.

Problem: Blister pack sealing. The packaging line had a blister pack sealing process that, when inspected, recorded a consistent rejection rate of 5%. The Lean Six Sigma team had targeted this but were unable to resolve the issue; they needed more information.

Solution and benefit: A real-time monitoring system was installed using OEE as the KPI. The quality component of the calculation provided additional confirmation of the 5% losses caused by the sealing process. When identifying quality losses it is usually important to understand their relationship to key process variables. In this example, the solution also recorded temperatures of sealing plates, heating cycles, indexing positions and raw materials suppliers. The Lean Six Sigma team was therefore able to correlate the quality losses with the process variables. In this case, the problem was resolved by using small controlled adjustments to the heating profiles; however, it was noted that heating profiles differed depending on the foil supplier (the heating and sealing properties of foils differed slightly). Upon resolution, the reject rate was reduced by 4.5% (i.e., to 0.5%) recovering £120 000 (around €145 000) in packing costs per year on each of the three lines.

In general, I would advise that, if a packaging line starts to run behind schedule, that the planning department be kept fully informed. By doing so, planning teams can either reassign assets wherever needed or aid in the identification of the inefficiency problem. In our experience our customers have found that, when a real-time system is used to calculate current packaging efficiency and this is provided to the planning team, they can react to daily issues and reschedule where necessary. This real-time 'plant to planning' link has enabled our customers to improve on time delivery by up to 5%.

Overall recommendations

The OEE of a typical pharmaceutical packaging line is, on average, around 30%, but we have seen a case where it has been as low as 17% (a UK pharmaceutical company supplying cardiovascular drugs). From our experience in other industries, packaging lines run at 65–75% when improvements have been made using data from real-time automated solutions. With world-class levels of OEE said to be above 85%,[2] this leaves a big margin for improvement for packaging lines within the pharmaceutical industry.

One failing that has regrettably occurred in the manufacturing software and automation industry is the supplier not fully understanding the customer's real goals and challenges. The customer may provide a process description for a project, but failing to fully understand why the project exists can result in limited benefits being accrued.

When providing a solution, it is important for the supplier to go through a phase of discovery with the customer so that there is a mutual understanding of the full reasons of why help is needed. Once the customer's goals are fully understood, a value can be placed on the potential benefits of a solution and thus a value can also be placed on the return on investment (ROI) expected from the solution. By understanding the full potential ROI, the project team can use this information as a focus for design, build and implementation.

When in the 'discovery phase', it is important that key success criteria are agreed by both parties; viewing the supplier/customer relationship as a partnership will only work when both parties benefit. So, to deliver the success criteria, a phase of value enablement is required. The 'value' is that of the items identified in the ROI. The 'enablement' is the supporting services, after implementation, between the supplier and customer that releases this value.

The fullest consideration of what OEE can tell us is required for packaging lines to achieve their full potential and deliver optimally to the business. There is much that can be done to dramatically affect the OEE of pharmaceutical packaging lines, the benefits of which will be sustainable and deliver increased profitability and competitiveness in the long run. **PTE**

References

1. M. Hammer, Harvard Business Review, **79**(8), 8291 (2001).
2. R.C. Hansen (Ed.), Overall Equipment Effectiveness: A Powerful Production/ maintenance Tool for Increased Profits (Industrial Press Inc., New York, US, 2001) p 12.

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